

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Original) A coder comprising:
 - an obtaining unit that obtains a predetermined amount of image data in which each pixel is expressed by a plurality of bits;
 - a developing unit that develops the pieces of bit data in the image data on virtual planes, wherein pieces of bit data of the same pixel are developed on the same virtual plane; and
 - a coding unit that performs entropy coding on the developed bit data in virtual plane units.
2. (Original) The coder according to Claim 1, wherein the pixel is expressed by 8 bits.
3. (Original) The coder according to Claim 2, wherein the developing unit develops pieces of bit data of each pixel in a 2 bit by 4 bit matrix.
4. (Original) The coder according to Claim 1, wherein the predetermined amount of image data is image data corresponding to one page.

5. (Original) The coder according to Claim 1, wherein the coding unit obtains a probability value of a target bit from reference bits and performs an arithmetic coding with prediction according to the obtained probability value, wherein the target bit is a subject of coding and the reference bits are in predetermined positions relative to the target bit.

6. (Original) The coder according to Claim 1, wherein the developing unit performs code conversion on the predetermined amount of image data before developing the pieces of bit data.

7. (Original) The coder according to Claim 6, wherein binary data is converted to gray codes in the code conversion.

8. (Canceled)

9. (Canceled)

10. (Original) A coding method comprising:
an obtaining step for obtaining a predetermined amount of image data in which each pixel is expressed by a plurality of bits;
a developing step for developing the pieces of bit data in the image data on virtual planes, wherein pieces of bit data of the same pixel are developed on the same virtual plane; and

a coding step for performing entropy coding on the developed bit data in virtual plane units.

Claims 11-23 (Canceled)

24. (Original) An image forming apparatus comprising:

a coder that includes:

an obtaining unit that obtains a predetermined amount of image data in which each pixel is expressed by a plurality of bits;

a developing unit that develops the pieces of bit data in the image data on virtual planes, wherein pieces of bit data of the same pixel are developed on the same virtual plane;

a coding unit that performs entropy coding on the developed bit data in virtual plane units;

a decoder that decodes data that has been coded by the coder and reconstructs image data; and

an image forming unit that forms an image using the image data that has been reconstructed by the decoder.

25. (Canceled)

26. (Previously Presented) A computer program embedded in a computer readable medium that performs coding processing of image data has a computer execute steps, the steps comprising:

a developing step for developing on virtual planes pieces of bit data in image data in which each pixel is expressed by a plurality of bits, wherein pieces of bit data of the same pixel are developed on the same virtual plane; and

a coding step for performing entropy coding on the developed bit data in virtual plane units.

27. (Canceled)

28. (New) A coder comprising:

an obtaining unit that obtains a predetermined amount of image data in which each pixel is expressed by a plurality of bits;

a BTC (Block Truncation Coding) processing unit that performs BTC processing on the obtained image data to obtain gradation characteristic data and quantized data;

a developing unit that develops pieces of bit data in the obtained gradation characteristic data on virtual planes; and

a coding unit that performs entropy coding on the developed bit data in virtual plane units.

29. (New) The coder according to Claim 28, wherein the developing unit performs code conversion on the obtained gradation characteristic data before developing the pieces of bit data.

30. (New) A coder comprising:

an obtaining unit that obtains a predetermined number of pixels of multivalued image data;

a BTC processing unit that generates gradation characteristic data and quantized data from pixel values of the pixels of the obtained multivalued image data;

a developing unit that develops pieces of bit data in the gradation characteristic data on first virtual planes; and

a coding unit that performs entropy coding on the developed bit data in first virtual plane units.

31. (New) The coder according to Claim 30, wherein

the developing unit develops pieces of bit data in the quantized data on at least one second virtual plane, and

the coding unit performs the entropy coding on the developed bit data in the quantized data in second virtual plane units.

32. (New) The coder according to Claim 31, wherein each piece of the quantized data corresponding to a different one of the pixels includes a plurality of pieces of bit data,

the coder further comprising a dividing unit that divides the pieces of bit data in the quantized data into a plurality of groups, wherein the developing unit develops pieces of bit data in the quantized data in a different group on a different virtual plane.

33. (New) The coder according to Claim 32, wherein the plurality of groups are a first group of upper bit data and a second group of lower bit data.

34. (New) The coder according to Claim 32, wherein
the predetermined number of pixels indicates a block of 4 pixels * 4
pixels, and
the developing unit develops pieces of bit data in each of the groups
obtained from each block of the multivalued image data in a 4 bit by 4 bit matrix.

35. (New) The coder according to Claim 31, wherein each piece of the
quantized data corresponding to a different one of the pixels includes a plurality of
pieces of bit data,
the coder further comprising:
a compression ratio obtaining unit that obtains a compression ratio for
the entropy coding; and
a judging unit that judges whether another quantized data is necessary
according to the compression ratio.

36. (New) The coder according to Claim 30, wherein the developing unit
performs code conversion on the pieces of bit data in the gradation characteristic
data before developing the pieces of bit data in the gradation characteristic data.

37. (New) The coder according to Claim 36, wherein binary data is converted to gray codes in the code conversion.

38. (New) The coder according to Claim 30, wherein each pixel is expressed by 8 bits in the multivalued image data.

39. (New) The coder according to Claim 30, wherein the predetermined number of pixels indicates a block of 4 pixels * 4 pixels.

40. (New) The coder according to Claim 39, wherein the developing unit develops the pieces of bit data in the gradation characteristic data obtained from each block of the multivalued image data in a 4 bit by 4 bit matrix.

41. (New) The coder according to Claim 30, further comprising a converting unit that converts the quantized data into a predetermined bit string, wherein the coding unit performs the entropy coding on the bit string.

42. (New) A coding method comprising:
an obtaining step for obtaining a predetermined number of pixels of multivalued image data;
a BTC processing step for performing BTC processing on pixel values of the pixels of the obtained multivalued image data and generating gradation characteristic data and quantized data;

a developing step for developing pieces of bit data in the gradation characteristic data on virtual planes; and

a coding step for performing entropy coding on the developed bit data in virtual plane units.

43. (New) An image forming apparatus comprising:

a coder that includes:

an obtaining unit that obtains a predetermined number of pixels of multivalued image data;

a BTC processing unit that generates gradation characteristic data and quantized data from pixel values of the pixels of the obtained multivalued image data;

a developing unit that develops pieces of bit data in the gradation characteristic data on first virtual planes;

a coding unit that performs entropy coding on the developed bit data in first virtual plane units;

a decoder that decodes data that has been coded by the coder and reconstructs image data; and

an image forming unit that forms an image using the image data that has been reconstructed by the decoder.

44. (New) A computer program embedded in a computer readable medium that performs coding processing of image data has a computer execute steps, the steps comprising:

an obtaining step for obtaining a predetermined number of pixels of multivalued image data;

a BTC processing step for generating gradation characteristic data and quantized data from pixel values of a plurality of pixels of multivalued image data;

a developing step for developing pieces of bit data in the gradation characteristic data on virtual planes; and

a coding step for performing entropy coding on the bit data in virtual plane units.